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Human papillomavirus vaccines in Picardy, France: Coverage and correlation with socioeconomic factors

Vaccination anti-HPV en Picardie : couverture vaccinale et déterminants socioéconomiques

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Abstract

Background. – In France, the human papillomavirus vaccine is routinely recommended for 14-year-old females and a ''catch-up'' vaccination should be offered to female adolescents who are between 15 and 23 years of age. Currently, few studies are available on the coverage rates in France. The aim of this study was to evaluate the coverage of the human papillomavirus vaccine and compliance with the vaccination scheme in Picardy, between 2009 and 2010, and to analyze the socioeconomic factors possibly influencing this coverage.

Methods. – We selected a female population that was affiliated with the national health insurance organization, living in the Picardy region of France, and aged between 14 and 23 years on 31st December 2010.

Results. – The coverage rate in the study population with at least one dose of vaccine was 16.8%. A complete vaccination scheme (three doses) was observed in less than 38.9% of them, so only 6.5% of this population had received the complete vaccination. Higher rates of coverage and compliance were observed in girls 14 years of age (65.5%) and if the prescriber was a gynecologist or pediatrician (respectively, 44.7% and 48.1%). There is a negative correlation between coverage and compliance and the percentage of single-parent families and immigrant families by canton area of Picardy. The economic cost of an inappropriate scheme was 1.3 million euros for Picardy in 2009.

Conclusion. – Coverage and compliance rates of human papillomavirus vaccines in Picardy appear to be low. This study suggests that health authorities in Picardy should provide communication and action campaigns to improve these results.
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Keywords: Human papillomavirus; Vaccination; Adolescents; Socioeconomic factors; Picardy

Résumé

Position du problème. – La vaccination contre le papillomavirus humain (HPV) est recommandée en France depuis avril 2007 chez les jeunes filles de 14 ans et en rattrapage chez les jeunes filles de 15 à 23 ans, en prévention des cancers du col de l'utérus. Actuellement, peu de données sur le taux de couverture vaccinale en France sont disponibles. L'objectif de cette étude était d'estimer le taux de couverture vaccinale en Picardie en 2009–2010, l'observance du schéma vaccinal parmi les femmes ayant reçu au moins une dose et de déterminer les facteurs socioéconomiques jouant sur ce taux.

Méthodes. – Il s'agit d'une étude rétrospective s'appuyant sur l'analyse des données de remboursements des vaccins anti-HPV pour les jeunes filles picardes âgées de 14 à 23 ans au moment de la délivrance de la première dose.

Résultats. – Dans la population d'étude, 16,8 % des affiliées ont reçu au moins une dose vaccinale. Le taux de couverture vaccinale avec schéma vaccinal complet a été estimé à 6,5 %. L'observance du schéma vaccinal était meilleure si la jeune fille démarrait la vaccination à 14 ans (65,5 %) et si le primo prescripteur était un gynécologue-obstétricien ou un pédiatre (respectivement 44,7 % et 48,1 %). Il existe une corrélation négative entre le taux de couverture vaccinale et le taux d'immigrés et de familles monoparentales par canton. Le coût de la mauvaise observance du schéma vaccinal a pu être chiffré à plus de 1,3 millions d'euros pour la Picardie en 2009.

Conclusion. – Le taux de couverture vaccinal contre le HPV en Picardie est faible. Ce faible taux constitue une perte de chance tant individuelle que collective. Ce travail souligne l'intérêt de mener des actions avec les acteurs locaux afin d'améliorer ces résultats.
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Mots clés : HPV ; Vaccination ; Adolescentes ; Facteurs socioéconomiques ; Picardie

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1. Introduction

In 2006, two prophylactic vaccines against human papillomaviruses (HPV) obtained marketing approval by the European Drug Agency (Agence européenne du médicament) and have been put on the market. Gardasil® (sold by Sanofi Pasteur MSD) is a quadrivalent vaccine targeting the high-risk genotypes 16 and 18 found in 70% of cervical cancers and the low-risk genotypes 6 and 11 [1–7]. Cervarix® (marketed by GlaxoSmithKline) is a bivalent vaccine directed against genotypes 16 and 18. These vaccines have demonstrated their efficacy in preventing the onset of precancerous lesions of the uterine cervix caused by HPV types 16 and/or 18 as well as precancerous lesions of the vulva and external genital warts caused by HPV type 6, 11, 16, and/or 18 [8–10].

In France, it is recommended to limit the use of these vaccines to 14-year-old girls and use them as "catch-up" in 15- to 23-year-old young women who have never had sexual relations or at the latest 1 year after their first sexual relations. The vaccination protocol providing maximum efficacy includes three doses to be administered over a 6-month period [11–13]. However, the High Council for Public Health (Haut Conseil en Santé Publique) has recently revised this recommendation and advised that vaccination take place between 11 and 14 years of age [14].

France has no organized HPV vaccination program. Vaccination is therefore opportunistic and left to the initiative of parents or the young women themselves. Yet it has been shown that the epidemiological impact on uterine cervical cancer is highly dependent on the level of vaccine coverage. The only data that can currently be used to evaluate the vaccination coverage in France are those from health insurance information systems. These are data on the reimbursements for the vaccines delivered to insured patients in pharmacies. Few studies have been conducted in France to measure the rate of vaccination coverage. Fagot et al. [15] showed that 37.5% of 14- to 23-year-old women had begun the vaccination in 2007–2008. However, these results are very heterogeneous at the national level: Rouzier showed that in Paris, between 2007 and 2009, only 17% of insured young women received a dose, reporting a 43% compliance rate [16].

The objective of this study was to estimate the vaccination coverage of young women in Picardy, France, for the 2009–2010 period based on data from the reimbursements for vaccine doses delivered and to study certain socioeconomic factors that could be influential.

2. Methods

This was a retrospective study based on the analysis of reimbursements for Gardasil® and Cervarix® vaccine reimbursements by the Régime Général (health insurance administration for employed personnel), the Régime Social des Indépendants (health insurance administration for the self-employed; RSI), and the Mutualité Sociale Agricole (health insurance administration for agricultural occupations; MSA) in Picardy, France. It examined all young women aged 14–23 years at the time the first dose of the vaccine was delivered, who were affiliated with one of the three health insurance organizations and who had received the first vaccine dose between 1st January 2009 and 31st December 2010. The data were extracted from the Système Informationnel de l'Assurance Maladie (SIAM-ERASME Régional) of the Caisse Régionale d'Assurance Maladie (national health insurance organization; CRAM) in the Nord–Pas-de-Calais-Picardie region and were completed by data from the Picardy MSA and RSI information systems data. All young women born between 1986 and 1996 who had been reimbursed for at least one Gardasil® or Cervarix® dose between 1st January 2009 and 31st December 2010 were identified. The data transmitted included information on the beneficiaries (anonymous identity number, year of birth, residence canton code), vaccine doses (CIP codes, delivery dates), and prescribers (specialization). Additional data concerning the demography of the female population belonging to one of the three health insurance organizations on 1st January 2010 according to year of birth were transmitted and the Service OSA (Observation, Statistique et Analyse; Observation, Statistics, and Analysis) of the Agence Régionale de Santé (regional healthcare agency; ARS), which provided data on the demography of healthcare professionals according to their specialization and the canton in which they practiced. Four socioeconomic indicators were collected for each canton from national data (INSEE): the percentage of immigrants, the rate of single-parent families, the median income per consumption unit, and the rate of taxable households.

The rate of vaccination coverage by at least one dose was defined as the number of young women who had received at least one vaccine dose during the reference period, divided by the number of young women born between 1986 and 1996 belonging to one of the three health insurance organizations on 1st January 2010.

As for compliance with the vaccine protocol, according to the French Health Authority for Health Transparency Commission (Commission de Transparence de la HAS) through a decree passed on 18 April 2007 and 5 March 2008, a 3-year period for the delivery of the three doses was chosen. Young women having received the three doses or more in less than 1 year were therefore considered compliant and the compliance rate was defined as the number of women having received the three doses or more in less than 1 year among those who received at least one dose. The calculation of the compliance rate only took into account those young women who began the vaccination in 2009 (without taking into account those who began the vaccination in 2010), which made it possible to partially control for a bias affecting the total number of doses received.

In addition, the impact on compliance of the prescriber's specialization and the patient's age at delivery of the first dose were studied. We also examined whether the coverage rate by canton was associated with the percentage of immigrants, the single-parent family rate, median income, and the rate of taxable households.

To calculate the cost of the vaccination, we took into account the price of the vaccine doses (123.66 € for Gardasil® and

111.82 € for Cervarix®), the number of doses delivered, and the price of the physician consultations (consultation at 23 € including the clinical and technical act), considering that one consultation was necessary for each dose delivered. The cost for the national health insurance system was calculated considering that each vaccine dose was reimbursed based on 65% of the retail price and that each consultation was reimbursed at a rate of 70% of the statutory fee. The cost of poor compliance was assessed considering that young women who had received one, two, or three doses but within more than 1 year were not properly immunized according to the HAS guidelines. Finally, for young women who received more than three doses, the number of doses beyond three was counted. The cost of each dose "lost" or delivered in excess was added to the fee of a physician's consultation.

3. Statistical analysis

The quantitative data were expressed as the mean and standard deviation and the qualitative data in absolute numbers and percentages. The coverage and compliance rates were compared using the χ^2 or the Fisher exact test as needed.

The association between the vaccination coverage and/or compliance rates and the socioeconomic indicators was estimated using the Pearson correlation coefficient. A *P*-value less than 0.05 was considered significant. The analyses were done using SPSS11.0 and R software.

4. Results

During the study period, the female population affiliated with one of the three health insurance programs in Picardy included 138,042 individuals aged from 14 to 23 years. In this population, 23,139 individuals received at least one vaccine dose between 1st January 2009 and 1st January 2011 (16.8%). During this period, 45,915 vaccine doses were delivered: 25,600 in 2009 and 20,315 in 2010, a 20.6% decrease. The monthly number of vaccine doses delivered declined regularly from January 2009 to December 2010, decreasing from 2576 doses delivered in January 2009 to 1554 in December 2010 (Fig. 1). The majority of these doses (92%) were prescribed by general practitioners. Obstetricians were the second providers of vaccine prescriptions (3.3% of the doses prescribed), followed by pediatricians (2.1%) and gynecologists (1.9%). Gynecologists in Picardy had prescribed a mean 26 doses per practitioner in 2 years, slightly more than general practitioners (25 doses per practitioner in 2 years), whereas obstetricians and pediatricians had prescribed 17 and 16 doses, respectively, per practitioner in 2 years. Over the entire 2-year period, 95.5% of the doses delivered were Gardasil® and 4.5% Cervarix®.

The rate of vaccine coverage by at least one dose was highest in the Aisne department (17.7% the individuals affiliated with a health insurance organization) and the lowest in the Oise department (16.0% of the affiliated members). Substantial discrepancies in vaccine coverage were noted between cantons, with the rate ranging from 4.7% (Breteuil canton, Oise) to 25.9% (Abbeville Nord canton, Somme) (Fig. 2). Young women affiliated with the MSA had a higher rate of vaccine coverage by at least one dose than the mean rate (22.1%), and women affiliated with the RSI had a lower vaccine coverage rate (14.6%) than the mean and a lower rate than that recorded for women affiliated with the Régime Général (16.7%) ($P = 0.0001$). One-quarter of patients (25.8% of the patients who had received at least one dose) were 15 years old at the time the first dose was delivered. Those who were 14 years old when the first dose was delivered (target population) made up a smaller proportion (22.3%) (Fig. 3). Between 2009 and 2010, we observed a 57% decrease in the number of young women aged 15–23 years at the time the first dose was delivered. This number decreased from 12,479 to 5415. Within the entire sample of women who had begun the vaccination in 2009, 58% had not followed the complete vaccination protocol and 3.1% had received the three doses, but over more than 1 year. Consequently, 61.1% of the young women in Picardy who had begun vaccination were not properly immunized. The young women living in the Aisne and Oise departments were the least compliant: 38.0% versus 40.3% in the Somme department. Significant discrepancies between cantons can be noted, with rates ranging from 22.4% (in the Compiègne Sud-Ouest canton) to 83.3% (in the Breteuil canton). The rate of vaccination coverage with the complete protocol was estimated for Picardy at 6.5% in 24 months, and few differences were observed in the three departments, but here also a difference

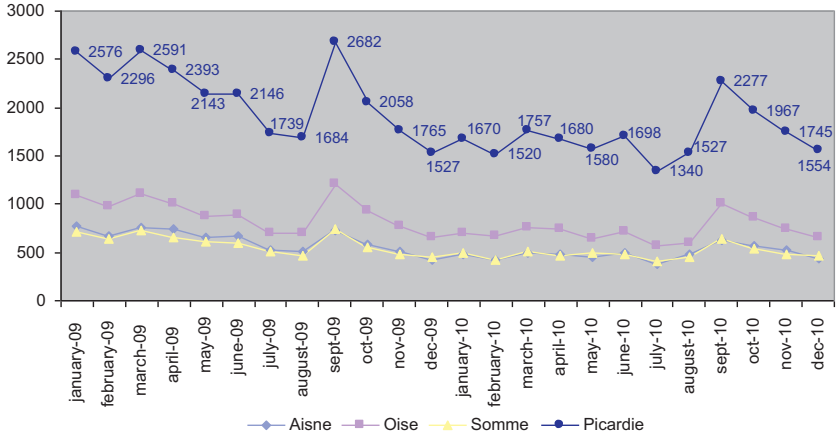

Fig. 1. Number of doses delivered monthly during the study period (2009–2010).

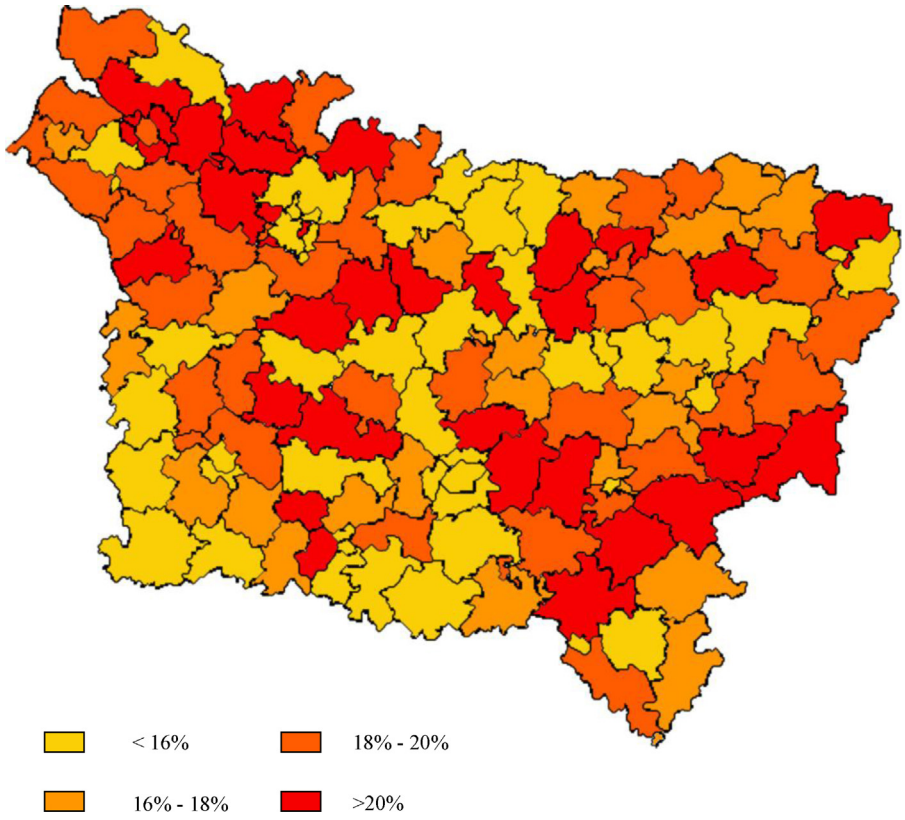

Fig. 2. Vaccination coverage (at least one dose) per canton in the Picardy region.

was observed between the cantons, with the rate varying from 3.5% (Combles canton) to 13.0% (Abbeville Sud canton).

The young women affiliated with the RSI were the most compliant (54.8% of those having received at least one vaccine dose had received the three in less than 1 year). Those affiliated with the RSA had a lower compliance rate (45.4%), but it was higher than those affiliated with the Régime Général (38.2%). The differences observed between health insurance organizations were statistically significant ($P < 0.001$).

The most compliant young women were those aged 14 years when the first dose was delivered (65.5%). In the population concerned by ''catch-up'' vaccination, the most observant were those at 15 years of age when the first dose was delivered (43.1%). For the 14- to 23-year olds who had begun vaccination in 2009 or 2010, the compliance rate was estimated at 38.9%. The vaccine coverage rate was highest for those born in 1995 (26.7% of the affiliated members). Those born in 1996 had a lower vaccination coverage rate (10.2%). In the population using ''catch-up'' vaccination, the coverage rate was highest in women born in 1994 (17.3%). It then decreased exponentially to reach 0.4% in women born in 1986.

Compliance of the vaccination scheme also differed depending on the specialization of the physician prescribing the first dose. If a general practitioner had prescribed the first vaccine dose, 38.3% having received the first dose received three doses within less than 1 year. If the first prescriber was a pediatrician or an obstetrician, these percentages were 48.1% and 44.7%, respectively ($P < 0.001$).

As for the investigation of factors that may influence the vaccination and compliance rate, a statistically significant

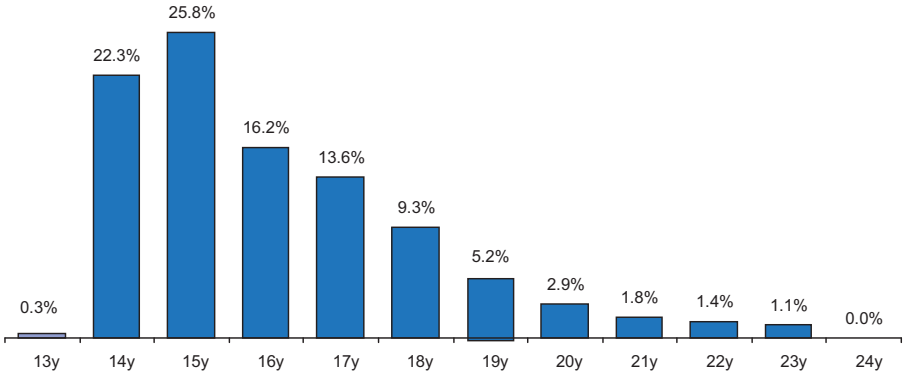

Fig. 3. Distribution of affiliated members who received at least one dose by age of delivery of the first dose.

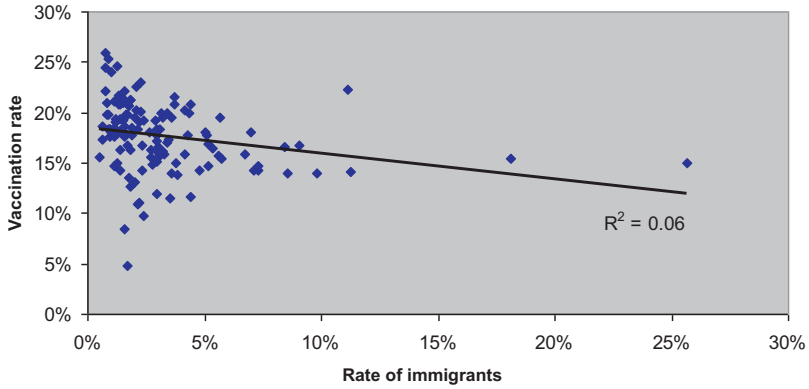

Fig. 4. Correlation between vaccination rate (at least one dose) and the rate of immigrants by canton in Picardy.

negative correlation was observed between the rates of immigrants per canton and vaccination ($R^2 = 0.06$; $P = 0.007$). There was also a statistically significant negative correlation with the rate of single-parent families per canton ($R^2 = 0.08$; $P = 0.002$). (Figs. 4 and 5). These negative correlations were also observed in the Somme and Aisne departments, but not in the Oise department.

As for the socioeconomic factors, no correlation between vaccination coverage, median income per consumption unit, and the percentage of taxable households was found ($P = 0.6$ and $P = 0.8$, respectively). The same factors as those related to vaccination coverage by at least one dose were found to be associated with complete vaccination coverage: the rate of immigrants ($R^2 = 0.1$; $P < 0.001$) and the rate of single-parent families ($R^2 = 0.12$; $P < 0.001$).

Vaccination of young women in Picardy in 2009 and 2010 cost the national health insurance approximately 4.4 million euros: 3.7 million euros for the cost of the vaccine doses (83% of the total expenditure). Poor compliance with the vaccination protocol was a substantial financial loss: 1.3 million euros in 2009 for young women in Picardy. This sum for the most part involves the cost of the vaccine doses (approximately 1.1 million euros for more than 13,500 doses).

5. Discussion

HPV vaccination coverage is low in Picardy, since only 16.8% of 14- to 23-year-old women had received at least one vaccine dose and only 6.5% had received the complete vaccine protocol. In the target population (14-year-old females in 2009 or 2010), approximately one out of three (32.3%) began vaccination, and the complete vaccination coverage of this target population is estimated at 18.5%. For the most part, young women in Picardy begin vaccination at 15 years of age, which does not correspond stricto sensu to the guidelines. However, a slight progression in beginning the vaccination between 2009 and 2010 (+12%) was noted for 14-year-old females. A study on the period ranging from July 2007 to August 2009 in those affiliated with Régime Général found for Picardy a 26% vaccination coverage rate, and 40% for 14-year-old in 2008 [15].

One problem raised by HPV vaccination is compliance with the vaccine protocol, since only 38.9% of the young women who began vaccination received three doses in less than 1 year. This problem is all the more preoccupying in that compliance seems to decrease over time. The study reported by Fagot et al. found 71% compliance for those affiliated with the Régime Général and 75% of 14-year-old affiliated members in 2008 [15]. Three other studies were conducted in Paris on the period from July 2007 to April 2009 [16], in the Nord–Pas-de-Calais region for the period extending from July 2007 to May 2009 [17] and in the Franche-Comté region for 2009 and 2010 [18]. In Paris, 17% of the members received at least one dose between July 2007 and April 2009, which is comparable to the situation in Picardy for the 2009–2010 period. The compliance rate for young Parisian women was 43%, comparable to those

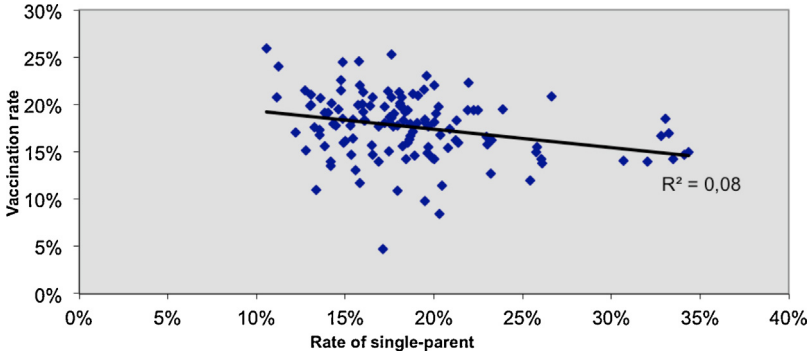

Fig. 5. Correlation between vaccination rate (at least one dose) and the rate of single-parent families by canton in Picardy.

in Picardy [16]. In the Nord–Pas-de-Calais region, 41.4% of the affiliated members 14 years of age and 59.8% of those 15 years of age received a first vaccine dose at this age. The compliance rate was 63.6% [17]. Young women in Picardy are therefore less well covered than their neighboring counterparts by the HPV vaccine. Fewer of them start the vaccination and compliance with the vaccine scheme is lower. Finally, in the Franche-Comté region, 11.3% of 14- to 23-year-old young women started vaccination (compared to 16.8% in Picardy) with a 32% compliance rate, a complete vaccination coverage rate of 3.6%, lower than that in Picardy [18].

The three-dose vaccination protocol must be respected even if the third dose is administered beyond 12 months after the first dose [14]. For the moment, few studies can justify a two-dose vaccination protocol. A study conducted in Costa Rica suggests that individuals who are vaccinated with fewer than three bivalent vaccine doses have comparable protection [14,19]. As for 14-year-old affiliated individuals, 29.7% of them started vaccination, with a 43.2% compliance rate and 51.3% for the 2009 and 2010 cohorts, respectively, for a 21% vaccination coverage rate. These results are disappointing, particularly since the importance of high vaccination coverage for a significant epidemiological impact on uterine cervical cancer has been underscored [20].

Two consequences result from poor compliance with the vaccination protocol: young women are not properly immunized and the cost for the national health insurance program is high (approximately 1.3 million euros per year). This financial loss corresponds to the costs of vaccination of slightly more than one-third of the population of 14-year-old females in Picardy in a given year (theoretical total cost, 3.4 million euros).

Several factors influencing compliance have been reported in the literature [21–26]. Two factors have been identified in the present study. First of all, the patient's age at the time the first dose is delivered: young 13- or 14-year-old are more compliant than their older peers (64.8% vs 33.6%). In addition, among the 15- to 23-year-old young women, those who are 15-years-old when the first dose is delivered respect the vaccination protocol more closely. These data are identical to those found in the literature [16]. At this age, young women are probably still accompanied by their mothers to medical consultations. It can be assumed that mothers are more vigilant in terms of respecting the vaccination protocol once the vaccination has been started. The other factor identified is the specialization of the prescribing physician. When the vaccine doses were prescribed by a specialist (notably a pediatrician or a gynecologist), a larger number of the young women received the three doses (48.1% and 44.7% for pediatricians and gynecologists, respectively, versus 38.3% for GPs) [27].

This study has demonstrated the discrepancies between departments in France in terms of HPV vaccination coverage. We found higher coverage rates in the Somme than in Aisne and Oise departments. We also noted discrepancies related to the young women's health insurance sector affiliation. The RSI and the MSA recorded better vaccination coverage for their members than the Régime Général. Information campaigns for each of these sections may be the source of the better results.

As for the specialization of the prescribing physician, nearly 92% of the doses are prescribed by general practitioners. Analysis of the number of doses prescribed per practitioner showed that gynecologists, specialists who are undoubtedly more aware of the problem of uterine cervix cancer, had on average prescribed a higher number of doses (26 doses per practitioner in 2 years) than GPs (25 doses per practitioner in 2 years) [27].

There are currently few studies on the socioeconomic determinants of vaccination coverage. The results found in the literature argue in favor of better vaccination coverage in high-income populations [16]. Studies on social inequalities in healthcare have shown lower access to prevention and primary medical care, and lower adherence to treatment for socially underprivileged populations [28]. However, the socioeconomic situation is not the only explanation. Studies on the acceptability of HPV vaccination demonstrate the role played by knowledge and beliefs [21]. Women and young women who are poorly informed on the causes of cervical cancer and prevention are less likely to get vaccinated [22]. In addition, improving knowledge on vaccination increases acceptability [23]. Concerning beliefs, the intention to get vaccinated is higher in individuals convinced of the vaccine's efficacy [21], but the fear of its side effects may be the reason for deciding against it [24]. The question of the role played by the opinion of physicians who prescribe these vaccines should also be raised. It seems probable that a physician opposed to HPV vaccination will be reluctant to prescribe it for his or her patients. A study on the perception of the HPV vaccine in general medicine conducted in the Somme department found among the obstacles to prescribing the vaccine the lack of perspective on the efficacy and the potential side effects, the fear of increasing risky sexual behavior, the fear of decreasing screening in vaccinated patients, and the reluctance to bring up questions of sexuality in young patients [29]. A study conducted in the Rhône-Alpes region on gynecologists found the same results [27].

Significant negative correlations were observed between the vaccination coverage rate and the rate of immigrants per canton as well as between the vaccination coverage rate and the rate of single-parent families. These factors seem to be related, without it being possible to deduce a cause and effect relationship. However, it can be assumed that the cultural factor is a major determinant in the acceptance of the vaccination, which could explain the relation found between the rate of immigrants and the vaccination coverage rate. The socioprofessional level of these populations may also be an explanatory factor. On the other hand, the median income per consumption unit and the rate of taxable households was not correlated with the vaccination coverage rate. The financial factor does not seem to be determinant in this study, but it should be remembered that this is an ecological correlation study at the canton level and that this type of correlation cannot be interpreted as causality (or an absence of causality) on an individual level. Rouzier and Giordanella demonstrated a positive correlation between the median per capita income by arrondissement and the vaccination coverage rate [16]. Similarly, Baudu's study found a positive significant association between the rate of vaccinated individuals per canton and

the number of taxable households, and an association at the limit of significance for median income in the Haute-Saône department. On the other hand, this study did not demonstrate a correlation between vaccination coverage and immigration [18]. It should be remembered that for an individual who did not have supplementary insurance beyond national health insurance coverage, the cost of the vaccination left to pay was approximately 150 €.

This study has a number of limits related to the type of data used. The data recorded in the databases of the National Health Insurance are intended to estimate the costs of healthcare services and healthcare products consumed by the beneficiaries and not to conduct epidemiological studies. We therefore hypothesized that each dose delivered was administered. Yet a certain number of members received more than three doses (up to six doses delivered). This may be an error of identification of the beneficiary on the part of the pharmacist for those entitled to healthcare coverage but do not have their own social security number (e.g., attribution to a sister), but this may also be individuals for whom the dose or doses may have been delivered but not administered. However, the number of affiliated members who received more than three doses was limited (approximately 1.5% of the members who had received at least one dose). In addition, this study only took into account the doses prescribed by private practitioners. The doses delivered in healthcare centers or at hospitals were not counted. However, the majority of the doses were prescribed by GPs; consequently, this number can be considered negligible.

In addition, the data concerned the population covered by one of the three main health insurance programs (Régime Général, RSI, or MSA), approximately 85% of the population. It did not cover the young women affiliated with special systems, notably those covered by the student health insurance. The 18- to 23-year-old population of affiliated members compiled was not as exhaustive as the 14- to 17-year-old population.

Compliance with the vaccination protocol is probably slightly underestimated in this work. Young women who began the vaccination in 2008 may appear in our database if they completed the protocol in 2009, but in this case they appear among the affiliated members who received only one or two vaccine doses, thus biasing the estimation of compliance. The problem was neutralized on the other side of the interval (patients who began vaccination in 2010) in only taking into account the young women who had begun vaccination in 2009 for the compliance calculation.

6. Conclusion

HPV vaccination coverage in Picardy in 2009–2010 is low and continues to decrease compared to 2008. Compliance with the vaccination protocol is mediocre, resulting in a substantial financial loss for the National Health Insurance and a loss of opportunity for the young women concerned and for the entire population. Compliance is better if the young woman begins vaccination early. This observation is valuable in future attempts to improve vaccination coverage by lowering the vaccination age. This is already current practice in several European countries that recommend beginning vaccination at 12 years of age. The different cultural and sociodemographic components that can play a role in the participation rate and the compliance rate for this vaccination should also be taken into account.

The arrival of vaccination may raise the fear of less use of screening measures for cervical cancer in young vaccinated women. However, the Haut Conseil de la Santé Publique (High Council for Public Health) recommends that all means be deployed to reach high vaccination coverage, particularly in young women living in socioeconomic conditions at risk for not benefitting from optimal conditions of regular cervical cancer screening. Nonetheless, for the above-mentioned reasons, vaccination should in no case substitute for screening. The HAS has also specified that within a few years it would be necessary to redefine the screening methods for young vaccinated women.

The fight against uterine cervical cancer can only be conceived as part of an overall strategy integrating both primary prevention by prophylactic vaccination and screening. Reflection on vaccination as a whole must therefore be engaged so as to improve vaccination coverage as wells as screening for vaccinated women.

Disclosure of interest

The authors declare that they have no conflicts of interest concerning this article.

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Appendix A. Supplementary data

Supplementary data associated with this article can be found, in the online version, at http://dx.doi.org/10.1016/j.respe.2013.04.005.

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